

## Climate Change Impacts in the Asia/Pacific Region

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### *Global CC threat*

The Stern Review and IPCC 4<sup>th</sup> Assessment Report both state that climate change will have adverse impact on people's health, safety and livelihoods, with the "poorest people in the poorest countries expected to suffer first and foremost". Predicted climate change will create barriers to future poverty reduction and reverse many of the important socio-economic gains made by developing countries.

### *CC in the A/P region*

In the Asia/Pacific region there is evidence of prominent increases in the intensity and/or frequency of many extreme events such as heat waves, tropical cyclones, prolonged dry spells, intense rainfall, tornadoes, snow avalanches, thunderstorms, and severe dust storms in the region. Furthermore, the region is highly subject to natural hazards, such as the 2004 Indian Ocean Tsunami, the 2005 Pakistan Earthquake, and the 2006 landslides in the Philippines. Such impacts pose additional risks for already vulnerable communities striving to combat poverty and achieve sustainable development. The Asia/Pacific region accounted for 91% of the world's total death and 49% of the world's total damage due to natural disasters in the last century. Therefore, climate change poses a serious and additional threat to poor farmers and rural communities in the region who live in remote, marginal areas such as mountains, drylands and deserts; areas with limited natural resources, communication and transportation networks and weak institutions.

In particular, climate models indicate **temperature increases in the Asia/Pacific region on the order of 0.5-2°C by 2030 and 1-7°C by 2070**. Temperatures are expected to increase more rapidly in the arid areas of northern Pakistan and India and western China. Additionally, models indicate rising rainfall concentration throughout much of the region, including greater rainfall during the summer monsoon. Furthermore, winter rainfall is likely to decline in South and Southeast Asia, suggesting increased aridity from the winter monsoon. The region will be affected by an **increase in global sea level of approximately 3-16 cm by 2030 and 7-50 cm by 2070** in conjunction with regional sea level variability. Other scientific studies have also indicated the potential for more intense tropical cyclones and changes in important modes of climate variability such as the El Niño-Southern Oscillation.

### *A/P vulnerability to CC*

Numerous factors show that the Asia/Pacific region possesses a high degree of vulnerability to such climatic changes affecting millions of poor rural people. The majority of the estimated 500 million rural poor in the Asia/Pacific region are subsistence farmers occupying mainly rain-fed land. Impacts of such disasters range from hunger and susceptibility to disease, to loss of income and human livelihoods. Climate change is in fact emerging as the pre-eminent development issues in the region.

The following are some the identified key aspects of the region's exposure, sensitivity, and adaptive capacity that contribute to its net vulnerability to climate change.

### *Exposure*

The Asia/Pacific region is exposed to a range of climate conditions and extreme events. In particular, some of the key features of the region's climate are the influences of

monsoons, the El Niño-Southern Oscillation, and cyclones on rainfall. Much of the region is adapted to, and thus reliant upon, the annual monsoon occurrence, which leaves it vulnerable when the monsoon fails and rainfall is significantly limited. Meanwhile, variability associated with the El Niño-Southern Oscillation, and particularly El Niño events, contributes to cyclic drought and extreme sea levels in the southwest Pacific. Finally, much of coastal Asia/Pacific is affected by tropical cyclones and their associated high winds, storm surge, and extreme rainfall. These climate challenges are permanent features of the Asia/Pacific region, but ones that may be significantly altered by anthropogenic climate change in the decades ahead.

#### *Sensitivity*

Besides being exposed to a variety of climate hazards, the vulnerability of the Asia/Pacific region is also affected by the sensitivity of different nations and sectors to these hazards when they occur. For example, with much of their subsistence and economic power dependent upon agriculture, the potential for widespread adverse impacts is improved in developing nations. Likewise, the development of existing water resources in many developing nations is limited as is, subsequently, access to safe drinking water and sanitation. In case of drought or flood, the ability to safely and efficiently manage water storage, diversion, and delivery may be easily compromised. Settlements and infrastructure in developing Asia/Pacific tend to be more susceptible to the effects of climate extremes and more likely to be damaged. Scientific studies show that low-lying coastal areas, including small island states, are more sensitive to the effects of sea-level rise and storm surge and thus have potentially more to lose from climate change than landlocked nations. Statistics indicate that extreme events in the region are associated with significant financial losses as well as the loss of lives, and disasters in the region have increased in recent decades.

#### *Adaptive capacity*

The Asia/Pacific region's exposure and sensitivity to climate variability and climate change creates a large potential for adverse climate impacts. On one hand, rapid growth in some national economies, such as China and India, suggests enhanced adaptive capacity to climate change thanks to economical, managerial, technological and infrastructural improvement. On the other hand, some economies are currently stagnating and some nations, such as small island states, have limited options available to adapt depending on their own financial and technical resources. Furthermore, continued rapid exploitation and degradation of natural resources and capital due to rapid urbanisation and economic development in a number of nations further reduces the resilience of some nations to climate variability and change. Rather than efficiently use resources to successfully address climate change impacts, which are considered long-term threats, some nations may invest their limited financial resources to face short term development needs.

#### *Economic impacts*

Climate change is projected to have negative effects on the sustainable development of most developing countries of Asia/Pacific, as it compounds the pressures on natural resources and the environment associated with rapid urbanization, industrialization and economic development. The net effect of climate change on regional and national economies is projected to be largely negative. Loss of agricultural revenue and additional costs for managing water resources, coastlines, and disease and other health risks will be a drag on economic activity. Given long term, sustainable economic development and growth in per capita wealth, such economic impacts may comprise a declining portion of total economic welfare, and regional capacity to effectively manage climate risk is likely to rise. Global economic damage from the negative impacts of climate change is placed by the insurance industry at hundreds of billions of USD each year.

Land and ecosystems are being degraded, threatening to undermine food security. In addition, water and air quality are deteriorating while continued increases in consumption and associated waste have contributed to the exponential growth in the region's existing environmental problems. Climate change will in fact affect many sectors which have different vulnerabilities to climate change, including agriculture, water, ecosystems and coastal zones.

### Agriculture

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Agriculture is the main source of livelihood for most rural people in the region and it is also the human activity most affected by climate change with serious losses of high-value agricultural lands. Studies indicate that production of rice, maize and wheat in the past few decades has declined in many parts of Asia due to increasing water stress arising mainly from increasing temperature, increasing frequency of El Nino and reduction in the number of rainy days. Even though increases in summer rainfall alone may benefit crop production and commercial forestry, particularly in South Asia, crop stress from rising temperatures may offset such benefits, particularly for rice yields. Even a limited increase in temperatures could lead to reduced crop yields for poor people living at lower latitudes, especially in seasonally dry and tropical regions. Additionally, more frequent and extreme events, such as droughts and floods, are expected to make local crop production even more difficult. It is projected that climate change will put around 49 million more people at risk of hunger by 2020. In particular, it is expected that crop yields could augment up to 20 per cent in East and South-East Asia while they could diminish up to 30% in Central and South Asia by mid-21<sup>st</sup> century.

Moreover, areas currently in water crisis, such as northeast China and flood-prone river deltas of Bangladesh and Vietnam, are expected to experience significant land degradation and loss in a changing climate. Considering the pressure of fast population growth and urbanization, the risk of hunger is expected to remain extremely high in several developing countries. Furthermore, for the least developed nations, such agriculture impacts may threaten not only food security, but also national economic productivity.

### Costal systems

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Costal areas, especially heavily-populated megadelta regions in South, East and South-East Asia, will be at greatest risk due to increased flooding from the sea and, in some megadeltas flooding from rivers. In particular, the megadeltas most vulnerable to climate disasters are Manila, Bangkok, Kolkata and Hoh Chi Minh City. Projected sea-level rise could threaten the livelihood of millions of poor rural people living in the low-lying areas of the Pacific Islands and South and South-East Asia such as Vietnam, Bangladesh and India. The high vulnerability is due to many factors including the geology and geography of some of the region's coastal zones, the growing density of population in the coastal zone, and the limited adaptive capacity of poor rural people.

The combined extreme climatic and non-climatic events caused costal flooding, resulting in substantial economic losses. Scientific studies indicated the region's coasts will continue to experience climate damages in the decades ahead. These damages include coastal inundation and erosion from sea-level rise, the displacement of communities, increased coastal management and defence costs, and the potential for more intense

tropical cyclones. Most at risk are poor people living in the low-lying river deltas of Bangladesh, India, Vietnam, and China as well as the small island states.

## **Ecosystems**

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The ecosystems within the Asia/Pacific region represent a key asset at local, regional and international level. They contribute directly and substantially to regional economies by providing food and water to sustain poor rural people as well as natural resources.

The natural ecosystems of the region will face increasing pressure from human activities and land use change. These factors will reduce the resilience of ecosystems to the effects of climate change and increase their vulnerability. In particular, the impacts of climate change will seriously affect coral reef communities, mangrove wetlands and forests.

Coral reefs are expected to be damaged from rises in the frequency of bleaching events, while the region is likely to lose 1-13% of its mangrove wetlands. In particular, the Pacific Islands hold the largest collection of coral communities worldwide, which are relied upon for local people mainly for beach defence, fisheries, and as a tourist attraction. Scientific studies document a high sensitivity of coral reefs of Asia/Pacific region to temperature variations. For example, coral reefs impacts in Fiji in face of less than 2 C° increase is expected to cause serious losses to fisheries aggravating the conditions of poor rural people. Like coral reefs, mangroves also provide habitat for the Asia/Pacific coastal biodiversity, shoreline protection and are key resources poor rural populations.

As for forest cover and vegetation, the overall impact on the forest ecosystems of the region is expected to be negative. In particular, increasing intensity and spread of forest fires in the region were observed in the past 20 years, largely attributed to the increase in temperature and decrease in precipitation coupled with rising intensity of land uses, especially in South-East Asia. For example, the 1997/1998 ENSO event in Indonesia triggered forest and brush fires in 9,7 million hectares, with serious national consequences for poor rural people dependent upon such ecosystems.

Wetlands are also being threatened by temperature increase. The precipitation decline and droughts in most delta regions of Pakistan, Bangladesh and India have resulted in the drying up of wetlands and severe degradation of ecosystems.

The natural grassland coverage and the grass yield in the region facing temperature increase and higher evaporation are also projected to decline. Large decreases in the natural capital of grasslands are likely in South Asia as a consequence of climate change. Sustainable land management should provide conditions that would promote greater rangeland resilience and provide better management strategy to tackle climate change in the region to offset the potential decrease of carbon storage and grassland productivity.

Furthermore, more frequent and prolonged droughts as a consequence of climate change will result in the increasing trends of desertification in the Asia/Pacific region affecting its natural ecosystems and the poor rural people dependent on them.

## Water

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Managing water resources to ensure a secure supply to growing populations is already a major challenge in many areas of the Asia/Pacific region. In particular, maintaining water security is a key priority for the poor rural people of the region, and climate change impacts to water resources may have a wide array of subsequent negative consequences.

Climate change is in fact expected to further modify the availability of water resources, driven by seasonal decreases in rainfall and runoff in South and Southeast Asia and increases in runoff in other areas, particularly the Pacific Islands. Glacier melt in the Himalayas is projected to increase flooding, and rock avalanches and to affect water resources within the next two to three decades. This will be followed by decreased river flows as the glaciers recede.

Freshwater availability in Central, South, East and South-East Asia, particularly in large river basin, is projected to decrease due to climate change which, along with population growth and increasing demand arising from higher standards of living, could adversely affect more than a billion of people by the 2050s. Expansion of areas under severe water stress will be one of the most pressing and urgent environmental problems in the region, especially in South and South East Asia, as the number of poor rural people living under serious water stress is expected to increase substantially in absolute terms.